

Claims

What is claimed is:

1. A tube for directing fluid along a path that includes a bend, the tube comprising:
  - 5 a conduit having a first aperture, a second aperture, and a bend portion adjacent the second aperture;  
an outer bend surface integrally formed as part of the conduit to at least partially define the second aperture;  
an insert including at least a portion of an inner bend surface, the insert disposed  
10 near the second aperture such that the outer bend surface and the inner bend surface cooperate to at least partially define the bend.
2. The tube of claim 1, wherein at least one of the conduit and insert is  
15 formed from a thermosetting plastic.
3. The tube of claim 2, wherein the thermosetting plastic includes polyester.
4. The tube of claim 1, wherein the bend portion at least partially defines a  
20 flange.
5. The tube of claim 4, wherein the conduit includes a substantially tubular  
portion.
6. The tube of claim 4, wherein the bend portion includes a pocket sized to  
25 receive the insert.

7. The tube of claim 1, wherein the bend portion includes opposed ridges positioned to engage the insert.

8. The tube of claim 1, further comprising a gasket positioned adjacent the  
5 insert and the bend portion.

9. The tube of claim 8, wherein the gasket cooperates with the conduit to retain the insert in a desired position.

10. The tube of claim 1, wherein the insert is bonded to the bend portion using  
10 an adhesive.

11. The tube of claim 1, further comprising a fastener operable to attach the insert to the bend portion.

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12. The tube of claim 11, wherein the fastener is a screw.

13. The tube of claim 1, wherein the fluid is an air-fuel mixture.

14. The tube of claim 1, wherein the fluid is a coolant.  
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15. The tube of claim 1, wherein the fluid is intake air.

16. The tube of claim 1, wherein at least one of the bend portion and insert  
25 includes a crush rib operable to attach the insert to the bend portion.

17. The tube of claim 1, wherein one of the bend portion and insert includes a female portion and the other of the bend portion and insert includes a male portion engagable with the female portion to attach the insert to the bend portion.

18. An engine comprising:
- an engine housing defining a combustion chamber;
  - a mixing device operable to mix a flow of fuel with a flow of air to produce an air-fuel mixture;
  - 5 a piston reciprocal within the combustion chamber in response to the combustion of the air/fuel mixture;
  - an intake tube positioned to receive the air-fuel mixture from the mixing device and deliver the air-fuel mixture to the combustion chamber, the intake tube including:
    - a conduit having a first aperture, a second aperture, and a bend portion;
    - 10 an outer bend surface integrally formed as part of the conduit to at least partially define the second aperture;
    - an insert including an inner bend surface, the insert cooperating with the outer bend surface to at least partially define the second aperture.
19. The engine of claim 18, wherein at least one of the conduit and insert is formed from a thermosetting plastic.
20. The engine of claim 19, wherein the thermosetting plastic includes polyester.
21. The engine of claim 18, wherein the bend portion at least partially defining a flange.
22. The engine of claim 21, wherein the conduit includes a substantially tubular portion.

23. The engine of claim 21, wherein the bend portion includes a pocket sized to receive the insert.

24. The engine of claim 18, wherein the conduit includes a flange surface and wherein the pocket inhibits motion of the insert in all directions except away from and normal to the flange surface.

25. The engine of claim 18, wherein the bend portion includes opposed ridges positioned to engage the insert.

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26. The engine of claim 18, further comprising a gasket adjacent the insert and the bend portion.

27. The engine of claim 26, wherein the gasket cooperates with the conduit to retain the insert in a desired position.

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28. The engine of claim 18, wherein the insert is bonded to the bend portion using an adhesive.

29. The engine of claim 18, further comprising a fastener operable to attach the insert to the bend portion.

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30. The engine of claim 29, wherein the fastener is a screw.

31. The tube of claim 18, wherein at least one of the bend portion and insert includes a crush rib operable to attach the insert to the bend portion.

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32. The tube of claim 18, wherein one of the bend portion and insert includes a female portion and the other of the bend portion and insert includes a male portion engagable with the female portion to attach the insert to the bend portion.

33. A method of manufacturing an intake crossover tube that defines a flow path having a bend, the method comprising:

providing a first mold that includes a first cavity shaped to form a conduit including an aperture at least partially defined by an outer curved surface of a bend;

5 providing a second mold that includes a second cavity shaped to form an insert including at least a portion of an inner curved surface of the bend;

filling the first mold cavity and the second mold cavity with a material to form the conduit and the insert;

10 positioning the insert adjacent the aperture such that the inner curved surface and the outer curved surface cooperate to at least partially define the bend.

34. The method of claim 33, wherein the first mold and the second mold are formed as a single family mold.

15 35. The method of claim 33, wherein the material includes a thermosetting plastic.

36. The method of claim 33, wherein the conduit includes a first flange surface and the insert includes a second flange surface, the first flange surface  
20 cooperating with the second flange surface to at least partially define an attachment flange.

37. The method of claim 33, further comprising positioning a gasket adjacent the insert and the conduit such that the gasket and the conduit cooperate to retain the  
25 insert.

38. The method of claim 33, further comprising attaching the insert to the conduit.

39. The method of claim 38, wherein the attachment step includes the  
5 application of an adhesive to at least one of the insert and the conduit.

40. The method of claim 38, wherein the attachment step includes the use of a fastener.